



# U.S. Department of Energy's Office of Science

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## Highlights of **Fusion Energy Sciences Program**

*PFC Meeting*  
*November 17-20, 2003*



[www.ofes.fusion.doe.gov](http://www.ofes.fusion.doe.gov)

## *Topics*

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- o Office of Science 20 Year Facilities Plan
- o ITER
- o NRC Report and Response
- o Budgets
- o OFES Organization

# *Office of Science*

## 20 Year Facilities Plan



“These Department of Energy facilities are used by more than 18,000 researchers from universities, other government agencies, private industry and foreign nations.”

- Secretary of Energy  
Spencer Abraham



# From the *Office of Science* 20 Year Facilities Plan:

## Process:

53 major facilities proposed by 5 Office of Science Advisory Committees and assessed according to two criteria: scientific importance and construction readiness

28 of 53 were selected and prioritized by Director, Office of Science, as most important scientific research facilities for the next 20 years

Result of process:  
ITER was ranked as #1

## Facility Summaries

### Near-Term Priorities

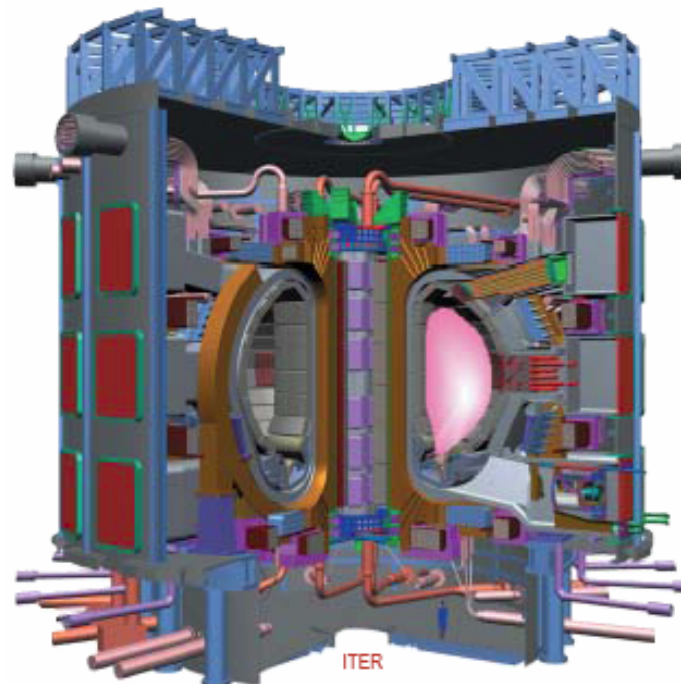
#### Priority: 1 ITER

**The Facility:** ITER is an international collaboration to build the first fusion science experiment capable of producing a self-sustaining fusion reaction, called a "burning plasma." It is the next essential and critical step on the path toward demonstrating the scientific and technological feasibility of fusion energy.

**Background:** Fusion is the power source of the sun and the stars. It occurs when the lightest atom, hydrogen, is heated to very high temperatures forming a special gas called "plasma." In this plasma, hydrogen atoms combine, or "fuse," to form a heavier atom, helium. In the process of fusing, some matter is converted directly into large amounts of energy. The ability to contain this reaction, and harness the energy from it, are among the important goals of fusion research.

**What's New:** Recent advances in computer modeling and in our understanding of the physics of fusion give us confidence that we can now build ITER successfully. The unique features of the facility will be its ability to operate for long durations (hundreds of seconds and possibly several thousands) and at power levels (around 500 MW) sufficient to demonstrate the physics of the burning plasma in a power-plant-like environment. ITER will also serve as a test-bed for additional fusion power-plant technologies.

**Applications:** ITER is the next big step toward making fusion energy a reality. Fusion energy is particularly attractive as a future energy source because it is environmentally benign (it produces no air pollution and no carbon dioxide, and it does not create long-lived radioactive waste); its fuels are easily extracted from ordinary water and from lithium, an abundant element; and it can be generated on demand and in sufficient capacity to power large cities and industries.



# *Excerpts from Secretary of Energy Spencer Abraham's Speech to the National Press Club*

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November 10, 2003

“The prospect of a limitless source of clean energy for the world leads with our commitment to join the international fusion energy experiment known as ITER.

This is a Presidential priority with enormous potential. Successful negotiations among the international partners will lead to the first-ever fusion science experiment capable of producing a self-sustaining fusion reaction.

If we reach agreement, **ITER will be our top facility.**”

# *ITER Negotiations*

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- o Negotiations at many levels ongoing since Nov. 2001 to develop an international agreement (Joint Implementing Agreement) for ITER construction
- o Good progress on major issues (site, key personnel, procurement package allocation, cost sharing,...)
- o First high-level meeting held in June 2003: P-series at Science Minister (Orbach) level
- o Second high-level meeting held in October 2003
- o Last working level meeting (NSSG-11) and Negotiators meeting (#9) held in Beijing (Nov. 5-12): all preparatory issues addressed, except for site and Joint Implementing Agreement text
- o **Negotiations could be concluded by end of 2003:**
  - o **EU Council of Ministers to meet on Nov 27. for decision on EU site**
  - o **Third high-level meeting of Science Ministers on Dec. 4 (Vienna) to agree on site, procurement package allocations, cost sharing, and General Director**
  - o **Energy Ministers meeting on Dec. 16 (Washington) to agree on major features of Joint Implementing Agreement**

# *Report of the NRC Burning Plasma Assessment Committee*

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- o Burning Plasma: Bringing a Star to Earth released September 24, 2003
- o Reviewed only Magnetic Fusion Energy
- o Major Conclusions
  - Burning plasma experiment needed to advance fusion science--join ITER but reassess and move ahead if ITER fails
  - Cannot be done with flat budgets, augmentation is required
  - Program should focus on realistic opportunities
  - Community should identify and **prioritize program elements needed for a balanced program** within the context of a program that includes ITER
  - ITER should be fully integrated into US Fusion Energy Sciences Program

# FESAC Charge on Prioritized Balancing

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- o Identify major science and technology issues to be addressed in research campaigns through 2014
- o Prioritize the campaigns under three budget scenarios:
  - At FY 2004 Cong. Req. level: \$257M plus inflation
  - At levels authorized in current draft of 2003 Energy Bill plus inflation for later years
  - At levels midway between the above
- o Assume that US participation in ITER construction is separate funding
- o Plan balanced program with ITER as part of an integrated whole
- o Include Inertial Fusion and relevant aspects of High Energy Density Physics in developing balanced, prioritized program

2003 Energy Bill Profile

FY 2004	\$335M
FY 2005	\$349M
FY 2006	\$362M
FY 2007	\$377M
FY 2008	\$393M



# FY 2004 Budget Information

## Presented to FESAC on November 17

- House-Senate Conference Report on FY 2004 E&WD Appropriations bill was issued on November 10
- Conference provided 6.8 \$M more than 257.3 \$M requested, specifying “restores 6.8 \$M to domestic fusion research”
- Budget process will not be complete until full House and Senate vote to approve FY 2004 E&WD Appropriations bill and it is signed by the President
- Based on interpretation of Conference Report and consultation with OFES senior staff, Anne Davies allocated 6.8 \$M and reported results to FESAC at November 17 meeting

# ***Fusion Energy Sciences Budget***

(\$ in Millions)

	FY 2002	FY 2003	FY 2004 <u>Cong. Request</u>	FY 2004 <u>Conf. Report</u>
Science	134.3	136.2	138.1	140.6
Facility Operations	70.8	66.2	87.7	88.7
Technology	36.0	38.3	24.9	28.2
SBIR/STTR	<u>0.0</u>	<u>6.2</u>	<u>6.6</u>	<u>6.6</u>
<i>OFES Total</i>	<i>241.1</i>	<i>246.9</i>	<i>257.3</i>	<i>264.1</i>
DIII-D	50.9	51.5	56.7	56.7
C-Mod	17.6	19.2	22.7	22.7
NSTX	27.0	30.1	35.2	35.2
NCSX	5.4	11.7	16.7	16.7

# The Bottom Line for Technology Programs

If FY 2004 Conference Report funding level hold (i.e., House & Senate approve and President signs E&WD Appropriations bill) and current OFES funding allocations are sustained, then:

- For overall fusion program, FY 2004 funding (264.1 \$M) will be 6.8 \$M above Cong. Request level (257.3 \$M) and **17.2 \$M above FY 2003 level** (246.9 \$M), **an increase of 7%**
- For technology programs, FY 2004 funding (**28.2 \$M**) will be 3.3 \$M above Cong. Request level (24.9 \$M) but **10.1 \$M below FY 2003 level** (38.3 \$M), **a decrease of 26%**
  - 28.2 \$M was provided for technology programs in the FY 2004 Oct. Financial Plan (i.e., the 3.3 \$M increase from the Cong. Request level has **already been provided**)
  - Technology programs will get **no additional funds** in FY 2004 (i.e., **will receive none of the 6.8 \$M** above the Cong. Request level for the overall fusion program)

# The Bottom Line for PFC Programs

- FY 2004 October/November budget (6.754 \$M) was .500 \$M above Cong. Request (6.254\$M) and **.204 \$M above FY 2003 level (6.550 \$M),  
an increase of 3%**
- FY 2004 December budget (**5.954 \$M**) will be .800 \$M below FY 2004 October/November level because all PPPL funding will be transferred to Experimental Plasma Physics program for transition in FY 2004 of CDX-U from ALPS/ALIST work to ICC work on LTX
- As is the case for all other technology programs, PFC program will receive **no additional funds** in FY 2004
- .139 \$M is still available as undesignated reserve in PFC program
- Unknowns that could affect PFC program/budget:
  - Will ITER be constructed with US as Party and, if so, what is impact on PFC program? (e.g., will “new” ITER funds be provided for ITER PFC work or will it be necessary to reprogram ALPS/ALIST to support ITER PFC work?)
  - Will anti-technology sentiment in OMB/OSTP (and OFES?) persist?
  - Will FESAC (or other forces) intervene on FY 2004 budget allocations?

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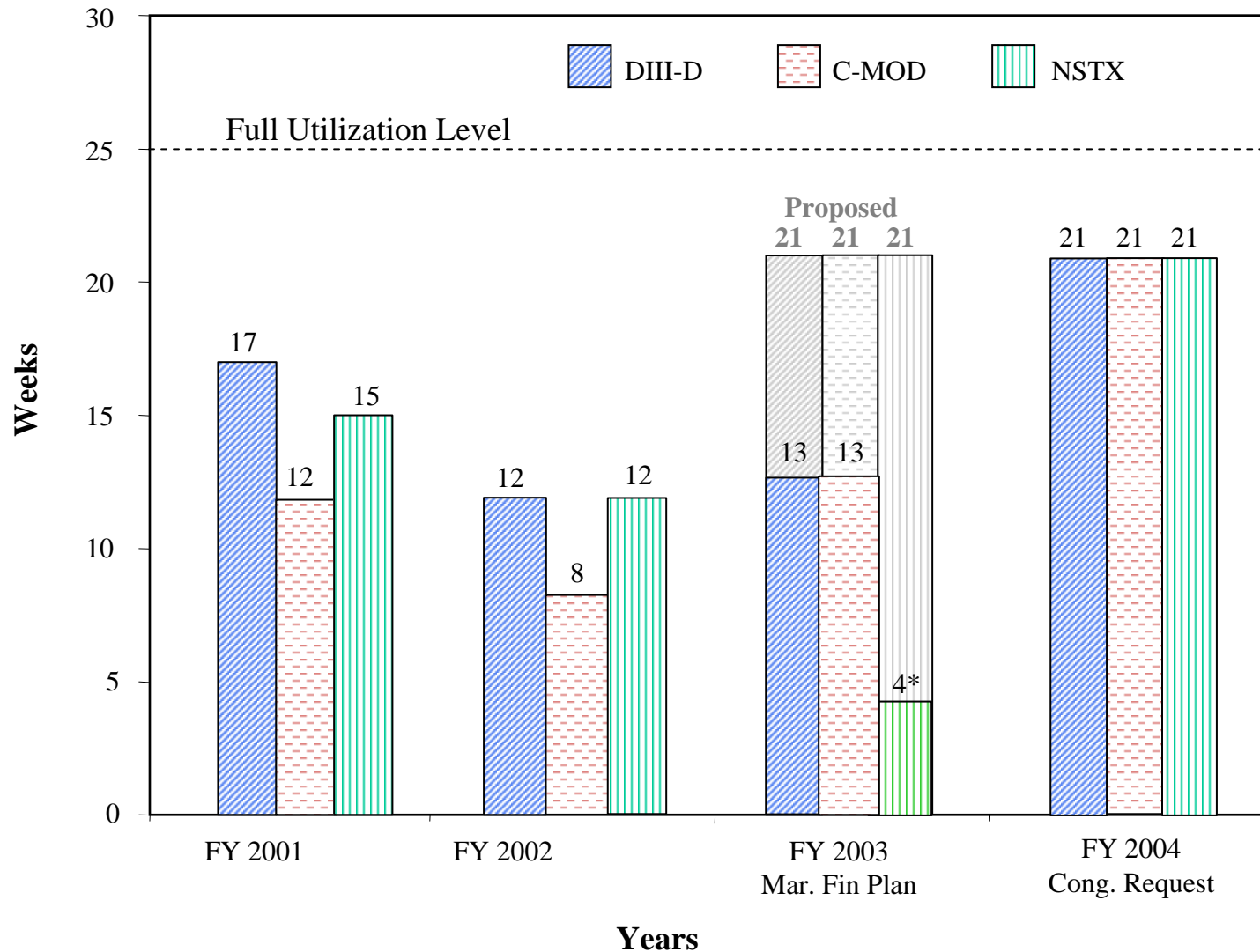
# ***FY 2004 OFES Budget***

## ***Current Financial Plan Development***

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- o Principles
  - Minimize personnel disruptions
  - Increase operation of facilities over FY 2003 level (~21 weeks)
  - Support ITER Transitional Arrangements, modest effort on FIRE
  - Rebalance science and technology elements, to some extent
  - Continue NCSX project
  - Support for Fusion Science Centers solicitations
  - Support National Lab portion of the NSF Science Center proposal
  - Partially restore cuts to international collaboration activities

# Major Fusion Facilities Operating Times



\*NSTX operating time was reduced due to the failure of one of the magnetic coils in February. Operations are expected to begin again in February 2004.